

WHAT IS CLAIMED IS:

1 1. An asynchronous interference avoiding method in a
2 network, comprising:

3 a first step wherein a slave station, which can
4 temporarily serve as a master station (a temporary master
5 station), in a temporary master station interposition-type
6 network receives a collision control downward packet from a
7 first temporary master station, which temporarily serves as a
8 master station, and judges whether or not a unique word for
9 synchronization contained in the collision control downward
10 packet is detected;

11 a second step wherein, when the slave station could not
12 have detected the unique word in the first step as a result of
13 interference caused by the send of the collision control
14 downward packet from the first temporary master station and a
15 second temporary master station as another temporary master
16 station in different timing, the slave station counts the
17 number of times of unique word undetection;

18 a third step wherein, when the number of times of receive
19 of the collision control downward packet and the number of
20 times of unique word undetection have exceeded or have become
21 equal to respectively preset thresholds, the slave station
22 judges, that asynchronous interference with the first temporary
23 master station has taken place, stops an attempt to synchronize
24 with the first temporary master station, temporarily functions
25 as a third temporary master station, and performs send/receive
26 in slot timing of the third temporary master station;

27 a fourth step wherein the third temporary master station
28 searches slots in all frequencies being used for a slot, which
29 exceeds or is equal to a preset threshold and has the highest-
30 receive field strength, and judges whether or not the slot
31 meeting the requirements has been detected;

32 a fifth step wherein, when the slot meeting the
33 requirements has been detected in the fourth step, the third
34 temporary master station judges that the slot is one in
35 interference with the first temporary master station, followed
36 by the send of an interference detection packet through a send
37 slot corresponding to the detected slot in a continuous manner
38 by the number of times which exceeds or is equal to a preset
39 threshold;

40 a sixth step wherein, when the interference detection
41 packet from the third temporary master station has been sent in
42 the same timing as the receive slot in the first temporary
43 master station or the second temporary master station, the
44 first temporary master station or the second temporary master
45 station recognizes the receive of the interference detection
46 packet and hops to a channel, which has been computed using
47 random numbers, to avoid the interference of the collision
48 control downward packet; and

49 a seventh step wherein, when the first temporary master
50 station has hopped to a new channel in the sixth step, the
51 third temporary master station hops to a channel corresponding
52 to the channel of the first temporary master station, is
53 returned in its function to the slave station, and receives the
54 collision control downward packet from the first temporary

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55 master station.

1 2. The asynchronous interference avoiding method
2 according to claim 1, wherein, in the sixth step,
3 when the interference detection packet has been sent from
4 the third temporary master station in timing different from
5 that in the slot of the first temporary master station and the
6 second temporary master station, the first temporary master
7 station and the second temporary master station cannot detect
8 the unique word and, when the count of the number of times of
9 unique word undetection has exceeded or has become equal to a
10 preset threshold within a preset time period, the first
11 temporary master station and the second temporary master
12 station each judge that the slot is an interfered one, followed
13 by hopping to channels which have been computed respectively
14 using random numbers.

1 3. The asynchronous interference avoiding method
2 according to claim 1 or 2, wherein the fifth step comprises
3 an eighth step wherein, when the slot meeting the
4 requirements could not have been detected in the fourth step,
5 the third temporary master station judges whether or not the
6 investigation of all the slots has been completed, and, when
7 the investigation has not been completed, staggers the slot
8 timing by half cycle, followed by return to the fourth step to
9 again investigate the receive field strength of all the slots.

1 4. The asynchronous interference avoiding method

2 according to any one of claims 1 to 3, wherein, in the eighth
3 step, when the investigation of all the slots has been
4 completed, the processing is ended.

1 5. The asynchronous interference avoiding method
2 according to any one of claims 1 to 4, wherein the first step
3 comprises

4 a ninth step wherein, when the first temporary master
5 station and the second temporary master station each send the
6 collision control downward packet in a synchronized state
7 through the same channel, the slave station detects the unique
8 word and, since the received packet is a packet wherein the
9 signal of the first temporary master station has been
10 interfered with the signal of the second temporary master
11 station, detects an error, and, as soon as the number of times
12 of receive of the collision control downward packet and the
13 number of times of packet error detection have exceeded or have
14 become equal to respective preset thresholds, judges that
15 interference with the first temporary master station has taken
16 place, followed by the send of a channel switching request
17 packet to the first temporary master station and the second
18 temporary master station, and

19 a tenth step wherein the first temporary master station
20 and the second temporary master station receive the channel
21 switching request packet and hop to channels which have been
22 computed respectively using random numbers.

1 6. The asynchronous interference avoiding method

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2 according to any one of claims 1 to 5, wherein the first step
3 comprises

4 a step wherein, when the first temporary master station
5 and the second temporary master station send the collision
6 control downward packet through respective separate channels,
7 the slave station detects the unique word and, since no packet
8 error is detected, judges that the slave station is in
9 synchronization with the first temporary master station, and
10 operates according to the operation of ordinary adhoc protocol.

1 7. The asynchronous interference avoiding method
2 according to any one of claims 1 to 6, wherein, in the third
3 step, when the number of times of receive of the collision
4 control downward packet is equal to or less than a preset
5 threshold, or when the number of times of unique word
6 undetection is equal to or less than a preset threshold, the
7 step is returned to the first step.

1 8. The asynchronous interference avoiding method
2 according to any one of claims 1 to 7, wherein, in the ninth
3 step, when the number of times of receive of the collision
4 control downward packet is equal to or less than a preset
5 threshold, or when the number of times of packet error
6 detection is equal to or less than a preset threshold, the step
7 is returned to the first step.

1 9. The asynchronous interference avoiding method
2 according to any one of claims 1 to 8, wherein

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3 the third step comprises a tenth step wherein, when the
4 slave station temporarily functions as a third temporary master
5 station, in all utilizable slots, the interference detection
6 packet is continuously sent by the number of times which
7 exceeds or is equal to a preset threshold, and

8 when the tenth step is executed, the processing in the
9 fourth step and the processing in the fifth step are not
10 carried out.

1 10. The asynchronous interference avoiding method
2 according to any one of claims 1 to 9, wherein

3 the fourth step comprises an eleventh step which
4 comprises: upon the detection of the slot meeting the
5 requirements, making an examination on whether or not the
6 unique word is detected; when the unique word has not been
7 detected, staggering the position of the slot by "1" bit
8 before; making an examination on whether or not the unique word
9 is detected; repeating said procedure in a range such that an
10 electric field can be detected; and, when the unique word has
11 been detected, sending a channel switching request packet
12 through a send slot corresponding to said slot to allow the
13 first temporary master station or the second temporary master
14 station to perform channel hopping, and

15 when the eleventh step is executed, the processing in the
16 fifth step is not carried out.

1 11. A storage medium comprising, recorded thereon, a
2 program which can execute the asynchronous interference

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3 avoiding method according to any one of claims 1 to 10.

1 12. A system for avoiding asynchronous interference in a
2 network, comprising:

3 a TDMA-TDD processor for performing processing regarding
4 TDMA-TDD;

5 a clock section for generating a periodic pulse signal
6 which is sent to an RF section and the TDMA-TDD processor;

7 an adhoc protocol processor for processing a protocol
8 used in an adhoc network;

9 a storage for the number of receive packets, for counting
10 and storing received packets;

11 a storage for the number of times of unique word
12 undetection, for storing the number of times of undetection of
13 a unique word of a collision control downward packet sent from
14 a temporary master station of the network;

15 a storage for the number of times of error detection, for
16 storing the number of times of detection of an error in the
17 received packet;

18 a hop destination channel computing section which
19 generates random numbers to compute a channel to which next
20 hopping is performed; and

21 a plurality of slave stations which can temporarily
22 perform the operation of the temporary master station, wherein

23 when the TDMA-TDD processor has detected the unique word
24 for synchronization of the temporary master station with the
25 slave station, and, when the number of times of receive of the
26 collision control downward packet in the storage for the number

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27 of receive packets and the number of times of detection of an
28 error in received packet in the storage for the number of times
29 of error detection have exceeded or have become equal to
30 respective preset thresholds, the adhoc protocol processor
31 judges that interference has taken place between a first
32 temporary master station and a second temporary master station
33 as another temporary master station among the temporary master
34 stations which send information to the slave station, while,
35 when the TDMA-TDD processor in the slave station cannot detect
36 the unique word and when the number of times of receive of the
37 collision control downward packet in the storage for the number
38 of receive packets and the number of times of unique word
39 undetection in the storage for the number of times of unique
40 word undetection have exceeded or have become equal to
41 respective preset thresholds, the adhoc protocol processor
42 judges that interference has taken place between the first
43 temporary master station and the slave station.

44 the TDMA-TDD processor, based on the judgment, made by
45 the adhoc protocol processor, such that interference has taken
46 place between the first temporary master station and the second
47 temporary master station, sends a channel switching request
48 packet to the first temporary master station and the second
49 temporary master station through the RF section for performing
50 the send/receive of radio waves, modulation, and demodulation,
51 while, based on the judgment, made by the adhoc protocol
52 processor, such that interference has taken place between the
53 first temporary master station and the slave station, the slave
54 station temporarily functions as a third temporary master

55 station which continuously sends, by the preset number of times,
56 an interference detection packet through a send slot
57 corresponding to a slot, among slots in all frequencies being
58 used, which exceeds or is equal to a preset threshold and has
59 the highest-receive field strength,

60 the hop destination channel computing section, based on
61 the channel switching request packet received by the first
62 temporary master station and the second temporary master
63 station, generates random numbers to compute a channel to which
64 next hopping is performed, while, in the first temporary master
65 station or the second temporary master station, upon judgment
66 on the receive of the interference detection packet, or upon
67 judgment on undetection of the unique word of the interference
68 detection packet, or upon judgment of the interference
69 detection packet as an error packet, in which an error has been
70 detected, in order to avoid interference, the hop destination
71 channel computing section generates random numbers to compute a
72 channel to which next hopping is performed, and

73 the third temporary master station, when the first
74 temporary master station has performed channel hopping, hops to
75 a channel corresponding to the channel of the first temporary
76 master station and then returns in its function to the slave
77 station to again receive, as the slave station, the collision
78 control downward packet from the first temporary master station.

1 13. The asynchronous interference avoiding system
2 according to claim 12, wherein the TDMA-TDD processor
3 comprises:

4 a frame processor which transfers, among packets received
5 from the RF section, only a packet related to the adhoc
6 protocol processor to the adhoc protocol processor;

7 a slot processor which extracts a receive packet of a
8 designated slot from a receive bit string received from the RF
9 section and embeds a send packet received from the frame
10 processor in a designated slot followed by transfer to the RF
11 section;

12 a unique word check section which detects the unique word
13 from the receive packet and notifies the adhoc protocol
14 processor of the result of whether or not the unique word has
15 been detected;

16 an error detector which examines whether or not there is
17 an error in the receive packet, notifies the adhoc protocol
18 processor of the result of error detection, and, when no error
19 has been detected, transfers the received packet to the frame
20 processor and receives a receive packet from the unique word
21 check section which has detected the unique word; and

22 field strength investigation means for investigating the
23 receive field strength, and wherein

24 the adhoc protocol processor, every time when the
25 notification of the undetection of the unique word from the
26 unique word check section has been received, adds "1" to the
27 value stored in the storage for the number of times of unique
28 word undetection and stores the obtained value in the storage
29 for the number of times of unique word undetection; every time
30 when the notification of receive packet error from the error
31 detector has been received, adds "1" to the value stored in the

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32 storage for the number of times of error detection and stores
33 the obtained value in the storage for the number of times of
34 error detection; and every time when the notification of unique
35 word detection or undetection from the unique word check
36 section has been received, adds "1" to the value stored in the
37 storage for the number of receive packets and stores the
38 obtained value in the storage for the number of receive packets.

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